

**WHAT IS CLAIMED IS:**

1. A microcontroller-based system for detecting ground-fault and grounded-neutral conditions in an electrical power distribution system having line and neutral conductors comprising:
  - 5 a sensor circuit containing a single current transformer producing an output signal responsive to current flow in both the line and neutral conductors of the electrical power distribution system,
  - a microcontroller receiving said sensor output signal and initiating the generation of a trip signal upon detection of said ground-fault or said grounded-neutral condition in
  - 10 said power distribution system, said microcontroller being programmed to
    - use said sensor output signal to detect ground-fault conditions during spaced time intervals, and
    - use said sensor output signal to detect grounded-neutral condition during intervening time intervals between said spaced time intervals,
    - 15 a circuit interrupter for interrupting current flow in said power distribution system in response to said trip signal, and
    - an analog memory circuit operable with both full-wave and half-wave power supplies to provide
      - a timing function to control said spaced time intervals and said
      - 20 intervening time intervals, and
      - a memory function set in response to detection of a ground-fault or grounded-neutral condition to resume a circuit trip if power is temporarily lost before said circuit interrupter activates.
- 25 2. A microcontroller-based system for detecting ground-fault and grounded-neutral conditions in an electrical power distribution system having line and neutral conductors comprising:
  - a sensor circuit containing a single current transformer that varies non-linearly with temperature, producing an output signal responsive to current flow in both the line
  - 30 and neutral conductors of the electrical power distribution system,

a microcontroller receiving said sensor output signal and initiating the generation of a trip signal upon detection of said ground-fault or said grounded-neutral condition in said power distribution system, and

a non-volatile memory associated with said microcontroller,

5 wherein said microcontroller is programmed during manufacture to

receive said sensor output signal at a given temperature, and

compute a predetermined ground-fault threshold value based on said sensor output and store said predetermined ground-fault threshold value in said non-volatile memory, and

10 compute a predetermined grounded-neutral threshold value based on said sensor output and store said predetermined grounded-neutral threshold value in said non-volatile memory.

3. A microcontroller-based system for detecting ground-fault and grounded-neutral conditions in an electrical power distribution system having line and neutral conductors comprising:

a sensor circuit containing a single current transformer producing an output signal responsive to current flow in both the line and neutral conductors of the electrical power distribution system, said current transformer having an inductance that varies with temperature.

an ambient temperature sensing circuit placed proximate to said current transformer, producing a voltage which varies linearly with ambient temperature conditions,

a programmable microcontroller having a pre-determined ground-fault threshold value and a pre-determined grounded-neutral threshold value stored in a non-volatile memory, said microcontroller being programmed to

calculate a modified ground-fault threshold value based on said predetermined ground-fault threshold value and the output of said ambient temperature sensing circuit,

30 calculate a modified grounded-neutral threshold value based on said predetermined grounded-neutral threshold value and the output of said ambient temperature sensing circuit,

use said modified ground-fault threshold value to detect a ground-fault condition,

use said modified grounded-neutral threshold value to detect a grounded-neutral condition, and

5           initiate the generation of a trip signal upon detection of said ground-fault or said grounded-neutral condition in said power distribution system, and  
a circuit interrupter for interrupting current flow in said power distribution system in response to said trip signal.

10   4.     A microcontroller-based system for detecting ground-fault and grounded-neutral conditions in an electrical power distribution system having line and neutral conductors comprising:

a sensor circuit providing an output signal, said sensor circuit containing  
current transformer which has an inductance that varies with temperature

15       and

a resonant circuit,

a programmable microcontroller containing a pre-determined ground-fault threshold value and a pre-determined grounded-neutral threshold value stored in a non-volatile memory, said microcontroller being programmed to

20           initiate a ping signal to produce a resonant oscillation in said sensor resonant circuit during a grounded-neutral test,

measure the frequency of said resonant oscillation to determine a change in the inductance of said current transformer,

25           calculate a modified ground-fault threshold value based on said predetermined ground-fault threshold value and said change in the inductance of said current transformer,

calculate a modified ground-fault threshold value based on said grounded-neutral threshold value and said change in the inductance of said current transformer,

30           use said modified ground-fault threshold value to detect said ground-fault condition,

use said modified grounded-neutral threshold value to detect said grounded-neutral condition, and

initiate the generation of a trip signal upon detection of said ground-fault or said grounded-neutral condition in said power distribution system, and

5 a circuit interrupter for interrupting current flow in said power distribution system in response to said trip signal.

5. A method of detecting ground-fault and grounded-neutral conditions in an electrical power distribution system having line and neutral conductors, comprising:

10 producing a signal with a single current transformer, responsive to current flow in both the line and neutral conductors of the electrical power distribution system,

supplying said signal to a microcontroller that is programmed to use said signal to detect ground-fault or grounded-neutral conditions in said power distribution system and initiate the generation of a trip signal upon detection of said ground-fault or grounded-

15 neutral condition,

interrupting the current flow in said power distribution system in response to said trip signal, and

using an analog memory to provide

a timing function to control intervals for testing for ground-fault or grounded-neutral conditions, and

20 a memory function set in response to detection of a ground-fault or grounded-neutral condition to resume a trip condition if power is temporarily lost before said current flow in said power distribution system is interrupted.

6. A method of detecting ground-fault and grounded-neutral conditions in an

25 electrical power distribution system having line and neutral conductors, comprising:

producing a signal with a single current transformer, that varies non-linearly over temperature, which is responsive to current flow in both line and neutral conductors of said electrical power distribution system, and

supplying said signal to a microcontroller that is programmed during manufacture

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receive said signal at a reference temperature and calculate a predetermined ground-fault threshold value based on said reference temperature,

and store said predetermined ground-fault threshold value in a non-volatile memory associated with said microcontroller, and

receive said signal at a reference temperature and calculate a predetermined grounded-neutral threshold value based on said temperature reference, and store said predetermined grounded-neutral threshold value in a non-volatile memory associated with said microcontroller.

7. A method of detecting ground-fault and grounded-neutral conditions in an electrical power distribution system having line and neutral conductors, comprising; producing a signal with a sensor, which varies non-linearly with temperature, responsive to current flow in both the line and neutral conductors of the electrical power distribution system,

producing an ambient temperature reading of said sensor, and

supplying said signal to a microcontroller having a predetermined ground-fault value and a predetermined grounded-neutral threshold value, said microcontroller being programmed to

use said ambient temperature reading to calculate a modified ground-fault threshold value based on said predetermined ground-fault threshold value,

use said ambient temperature reading to calculate a modified grounded-neutral threshold value based on said predetermined grounded-neutral threshold value,

use said signal to detect ground-fault conditions based on said modified ground-fault threshold value,

use said signal to detect grounded-neutral conditions based on said modified grounded-neutral threshold value,

initiate the generation of a trip signal upon detection of a ground-fault or grounded-neutral condition, and

interrupt the current flow in said power distribution system in response to said trip signal.

8. A method of detecting ground-fault and grounded-neutral conditions in an electrical power distribution system having line and neutral conductors, comprising:

producing a signal responsive to current flow in both the line and neutral conductors of the electrical power distribution system with a sensor containing a resonant circuit and a current transformer having an inductance that varies with temperature,

supplying said signal to a microcontroller having a pre-determined ground-fault  
5 threshold value and a pre-determined grounded-neutral threshold value, and

said microcontroller being programmed to

initiate a ping signal to produce a damped oscillation in a sensor output signal during a grounded-neutral test,

measure the frequency of said damped oscillation to determine a change in  
10 the inductance of said current transformer,

calculate a modified ground-fault threshold value based on said predetermined ground-fault threshold value and said change in the inductance of said current transformer,

calculate a modified ground-fault threshold value based on said grounded-  
15 neutral threshold value and said change in the inductance of said current transformer,

use said modified ground-fault threshold value to detect a ground-fault condition,

use said modified grounded-neutral threshold value to detect a grounded-  
20 neutral condition, and

initiate the generation of a trip signal upon detection of said ground-fault or said grounded-neutral condition in said power distribution system.

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